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The Diet of the Lesser Bandicoot Rat, *Bandicota bengalensis*, in Wheat and Rice Crops in Central Punjab, Pakistan

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Abstract.- An analysis was made of the diet of 144 lesser bandicoots rats, *Bandicota bengalensis*, trapped in wheat, rice and adjacent fodder crops in central Punjab. The diet of bandicoot rats in wheat field showed increasing utilization of wheat plants and grains as the crop approached maturity. Herbs, grasses and tubers formed decreasing proportions of the diet as wheat utilization increased. Rats trapped in and around rice fields were not feeding on rice in August but ate mainly grass seeds and sorghum. In October as rice harvest neared, they ate mainly rice grains (75%) and stems (12%). The rest were seeds of *Echinochloa crus-galli* and *Setaria pumila*, common weeds found in that area.

Key words: Lesser bandicoot rat, *Bandicota bengalensis*, diet, central Punjab, Pakistan.

INTRODUCTION

The diet of the lesser bandicoot rat, *Bandicota bengalensis*, in several crops in south Asia has only recently been studied. It infests many crops, but three, namely rice, wheat, and sugarcane, are its main targets. Several authors have looked at the diet of bandicoot rats in sugarcane fields. Smiet *et al.* (1980) reported that sugarcane was eaten every month in lower Sindh and 75% of the diet in November, December and January was cane. Wheat was eaten in February and March, but rice was never a part of the diet. Insects were always eaten, comprising up to 13% of the diet. Butt (1990) examined 43 rats from sugarcane fields near Faisalabad and found that 80% of their diet was sugarcane, predominantly from September through February, while sorghum made up most of the rest.

Bandicoots in wheat fields feed heavily on the crop from sowing in November until after wheat in May. Ismail (1987) found that the diet just after wheat harvest was 100% wheat. Hussain (1989) found that rats from wheat fields near Islamabad ate the vegetative parts (leaves and stems) of wheat, wheat grains, the rhizomes of *Desmostachya bipinnata*, and the seeds, flowers and rhizomes of *Cynodon dactylon*. Wheat consumption started in November and continued through August. By April, wheat grains were more than 97% of the diet. There was an inverse relationship between the consumption of wheat and the rhizomes of *Desmostachya* from November through March. Butt (1990) examined the stomach contents of 7 bandicoot rats from wheat fields near Faisalabad. They ate 53% of their diet in wheat, while sugarcane (13.2%), *Phalaris minor* (10.8%), oats (8.4%), and lucerne (*Medicago sativa*, 6.0%) made up most of the rest.

Lathiya (1990) examined the stomach contents of 166 *B. bengalensis* collected in lower Sindh. Twelve species of plants were identified. The most important were rice (leaves and grains), *Scirpus maritimus, Paspalidum geminatum* (seeds), and insects. Rice grains increased in proportion from August through October while rice leaves decreased. Tubers of *S. maritimus* were heavily consumed (82% of stomach contents in January) when rice was absent.

Thus, habitat and seasonal change have strong influences on what bandicoots eat. Our purpose in the present study was to determine short-term changes in diet as the wheat and rice crops grew and matured, from flowering stages through ripening. We were interested also in the importance of weeds and grasses in off-setting eating of the grain crops. To help answer these questions, we trapped rodents from growing wheat and rice fields in Gujrat District, Punjab, Pakistan, and examined their stomach contents.

MATERIALS AND METHODS

Rodents were trapped in snap traps placed in wheat, rice, and adjacent sorghum, sugarcane, and fodder fields during different growing seasons from March 1990 to April 1991. Stomach contents were removed from necropsied rodents and preserved in 5% formalin.

The stomach contents were prepared using a modification of the methods of Williams (1962) and Ward (1970). To identify the fragments of various

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vegetation and crops in the stomach, all possible plant species were collected from the trapped habitats to form a reference collection. Reference slides were prepared using a Virtis homogenizer to reduce root, stem, leaf, flowers, and seeds to microparticles. After homogenizing, contents were poured into microsieves and processed. Tissues were soaked overnight in a plant soaking solution, then cleared in warm sodium hypochlorite solution. They then passed through a mordant solution, were washed, stained, and mounted on microslides.

Slides of reference materials were examined for plant cell characteristics. Stomach contents were then examined and compared, using a 10 x 10 mm ocular grid micrometer to record the frequency of occurrence of different fragments. One hundred microscopic fields were examined on each slide for each stomach.

RESULTS

The percentage composition of the various food items found in the diet of lesser bandicoot rats during the 1990 and 1991 wheat growing seasons is given in Table I. A similar trend in increasing utilization of wheat and a corresponding decrease in use of grasses and herbs was apparent in two growing seasons. Wheat was ripening in both years in the last weeks in April and was harvested in early to mid-May.

Table I.- Percentage composition of several food items in stomachs of *B. bengalensis* trapped in wheat fields in 1990 and 1991.

Plant species	1990			1991	
(No. of stomachs)	March (14)	April (30)	May (29)	March (10)	April (19)
Triticum aestivum	69.0	83.9	94.7	61.8	79.9
Convolvulus spp.	11.0	6.6	3.7	18.2	4.5
Conodon dactylon	5.8	6.2	1.6	6.8	2.2
Cyperus rotundus	7.7	-	-	6.6	1.8
Ranunculus muricatus	6.5	3.5	-	6.6	9.8
Unidentified	-	-	-	-	1.8

Wheat was found in 90 to 100% of the rats stomachs from March through May (Table II). In March, the seeds and rhizomes of the grasses and herbs were also eaten frequently. These foods decreased in proportion as the wheat matured.

Table II.- Frequency of occurrence of several food items in stomachs of *B. bengalensis* trapped in wheat fields in 1990 and 1991.

Plant species	1990			1991	
(No. of stomachs)	March (14)	April (30)	May (29)	March (10)	April (19)
Triticum aestivum	92.9	93.3	93.1	100.0	100.0
Convolvulus spp.	14.3	20.0	10.3	40.0	15.8
Conodon dactylon	7.1	12.0	6.9	20.0	10.5
Cyperus rotundus	14.3	-	-	40.0	10.5
Ranunculus muricatus	21.4	10.0	-	20.0	58.0

The diet of bandicoot rats in and around rice fields in the same area in central Punjab is given in Table III. Seeds of grasses are the important dietary items in August, while rice plants were at flowering stage. Sorghum was minor item since some rats were captured from sorghum fields adjacent to rice fields at this time. In October, however, bandicoot rats had shifted to rice grains and stems (86.6%) as the major diet, and seeds and stems of the grasses *Echinochloa crus-galli* and *Setaria pumila* were decreasing in importance. Rice was found in 89.4% of the rat stomachs trapped during October while *Echinochloa crups-galli* and *Setaria pumila* were found in 46% of stomachs in August (Table IV).

Table III.- Percentage composition of several food items in stomachs of *B. bengalensis* trapped in rice and adjacent fodder fields in 1990.

Plant species	August	October
Sorghum vulgare	25.1	-
Dactylocteneum aegypticum	25.0	-
Echinochloa crus-galli	41.7	5.6
Setaria pumila	8.2	4.8
Oryza sativa	-	86.6
Unidentified	-	2.3

DISCUSSION

In both cereal grains, bandicoot rats relied on grass and weed seeds in the earlier crop growth stages. These food items decreased in proportion as the rats fed increasingly on the grains as the cereal grains

Table IV.- **Frequency of occurrence of different food items in stomach of *B. bengalensis* trapped in rice and adjacent fodder fields in 1990.**

Plant species	August	October
Oryza sativa	-	89.4
Setaria pumila	46	5.3
Echinochloa crus-galli	46	5.3
Sorghum vulgare	25	-
Dactyloctenium aegyptium	21	-
Unidentified	-	10.5

approached maturity. In the earlier growth stages in wheat, bandicoots utilized mainly leaves and stems of wheat in their diet, switching to grains as the "milky" and ripening stages appeared. Hussain (1989) found this same pattern in wheat fields near Islamabad. There was an inverse ratio in the consumption of wheat plant tissues and grain and the consumption of the rhizomes of *D. bipinnata*. Lathiya (1990) also found this pattern in bandicoot rats living in rice fields in lower Sindh.

One might assume that increasing utilization of a grain crop by rats as the growth stages approach maturity would mean increasing damage. Surprisingly this is not necessarily so. The tiller-cutting activities by bandicoot rats in a wheat crop are more intense in the earlier growth stages, at booting and flowering, than they are at maturity (Valvano and Mitchell, 1985). This apparently is so because much more plant tissues (stems, leaves, growing tips) are needed for rat nutrition in the earlier stages and much less of the ripening grains are needed in the late growth stages. However, because bandicoot rat cuts and hoards grain panicles in their burrow systems, damage tend hoards to increase as maturity approaches. This is shown graphically in Figure 1 where damage assessment in wheat during the crop growth stages showed an increase in damage as harvest drew near.

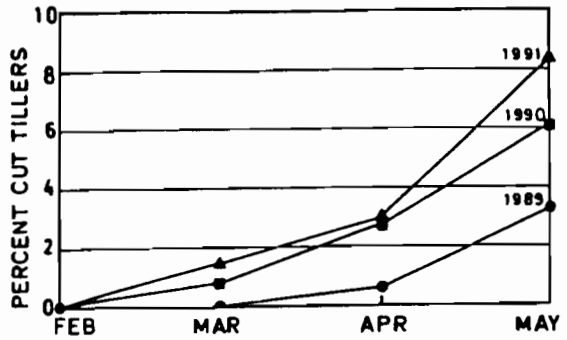

Fig. 1. Increase in wheat damage.

Weeds and grasses are important in the rats diet when the grain crops are still in the vegetative stages. In wheat fields, several species of grasses and herbs, much as *Cynodon, convolvulus, Cyperus* and *Ranuculus* served as food for the rats until the ripening stages. In rice, the grasses *Echinochloa, Setaria* and *Dactylocteneum* served as alternate foods until rice grains ripened.

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